



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION IX  
75 Hawthorne Street  
San Francisco, CA 94105

September 29, 2005

Bruce Wolfe  
Executive Officer  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Re: Five-Year Review Report for the Intersil/Siemens Superfund Site, Cupertino, Santa Clara County, CA

Dear Mr. Wolfe:

The U.S. Environmental Protection Agency, Region 9 (EPA) has reviewed the Second Five-Year Review Report for the Intersil/Siemens Superfund Site, Santa Clara, CA, prepared by the California Regional Water Quality Control Board, San Francisco Bay Region, dated September 30, 2005. This Five-Year Review was conducted as a matter of EPA policy because cleanup of the site will take five years or more to complete (see OSWER No.9355. 7-03B-P, Comprehensive Five-Year Review Guidance, June 2001). The review addresses remedial actions taken pursuant to the September 1990 Record of Decision for the site. EPA concurs that the groundwater remedy for the Intersil/Siemens site currently protects human health and the environment because unacceptable risks are being controlled, and because there are institutional controls in place that are preventing exposure to, and the ingestion of contaminated groundwater. Also, current information available indicates that the vapor intrusion pathway is not complete at the site due to on-site building design, and is unlikely at the downgradient residential area due to levels found in the groundwater and other factors, such as hydraulic control of the plume. However, it is recommended that the groundwater monitoring program in the off-site area should continue, and the vapor intrusion should be evaluated if concentrations in groundwater increase. Hydraulic control of the contaminated plume should continue until the groundwater cleanup goals are achieved. In addition, in-situ remedial technologies can be assessed in an effort to expedite the cleanup process, particularly in areas where the groundwater extraction and treatment system is not efficiently removing VOCs from the groundwater.

The next Five-Year Review for the Intersil/Siemens site will be due by September 30, 2010. EPA appreciates the opportunity to work with you on this report. If you have any questions, please feel free to contact Penelope McDaniel of my staff at 415-972-3178.

Sincerely,

A handwritten signature in black ink, appearing to read "Elizabeth Adams", written in a cursive style.

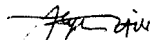
Elizabeth Adams  
Chief, Site Cleanup Branch  
Superfund Division, US EPA

**California Regional Water Quality Control Board  
San Francisco Bay Region**

**Third Five-Year Review**

**Intersil/Siemens Site  
Cupertino, Santa Clara County, California**

**Report Approved by:**



Digitally signed by Stephen Hill  
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September 29, 2005

**Stephen A. Hill**

**Date**

**Chief, Toxics Cleanup Division**

**California Regional Water Quality Control Board**

**San Francisco Bay Region**

**Report Concurred by:**



September 29, 2005

**Elizabeth Adams**

**Date**

**Chief, Site Cleanup Branch**

**Superfund Division, US EPA**

**California Regional Water Quality Control Board  
San Francisco Bay Region**

**Third Five-Year Review**

**Intersil/Siemens Site  
Cupertino, Santa Clara County, California**

**Report Approved by:** \_\_\_\_\_ September 29, 2005  
**Stephen A. Hill** **Date**  
**Chief, Toxics Cleanup Division**  
**California Regional Water Quality Control Board**  
**San Francisco Bay Region**

**Report Concurred by:** \_\_\_\_\_ \_\_\_\_\_  
**Elizabeth Adams** **Date**  
**Chief, Site Cleanup Branch**  
**Superfund Division, US EPA**

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## LIST OF ACRONYMS

AMI .....	AMI Semiconductors
ARAR .....	applicable or relevant and appropriate requirement
bgs.....	below ground surface
BPHE .....	Baseline Public Health Evaluation
Clayton.....	Clayton Group Services, Inc.
DCE .....	dichloroethene
ESL .....	Environmental Screening Level
Final SCR.....	Site Cleanup Requirements Order No. 90-119
GE .....	General Electric Company
Geomatrix .....	Geomatrix Consultants, Inc.
gpm .....	gallons per minute
GWETS.....	groundwater extraction and treatment system
HMSA.....	hazardous material storage area
Intersil.....	Intersil, Inc.
lbs/MG .....	pounds of VOCs per million gallons
Litronix .....	Litronix, Inc.
LFR.....	LFR Levine-Fricke
MCL.....	Maximum Contaminant Level
mg/kg .....	milligrams per kilogram
mg/l.....	milligrams per liter
mg/m <sup>3</sup> .....	milligrams per cubic meter
NPDES.....	National Pollutant Discharge Elimination System
NPL.....	National Priorities List
O&M.....	operations and maintenance
ORD.....	U.S. EPA Office of Research and Development
PCE .....	tetrachloroethene
ROD.....	Record of Decision
SCR.....	Site Cleanup Requirements
Siemens.....	Siemens Components, Inc.
Site .....	Intersil/Siemens Site located in Cupertino, California
SMI .....	SMI Holding, LLC
SSP&A.....	S.S. Papadopoulos & Associates
SVE.....	soil-vapor extraction
SVES .....	soil-vapor extraction system
SVOC.....	semivolatile organic compound
TCA .....	trichloroethane

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TCE..... trichloroethene  
U.S. EPA..... U.S. Environmental Protection Agency  
UST..... underground storage tank  
VOC..... volatile organic compound  
Water Board..... Regional Water Quality Control Board



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## EXECUTIVE SUMMARY

The Intersil/Siemens Site (“the Site”) is located in Cupertino, Santa Clara County, California and includes the former Intersil facility (10900 North Tantau Avenue), the former Siemens facility (10950 North Tantau Avenue), and the Off-Site Study Area (north of and hydraulically downgradient from the former Intersil and Siemens facilities). Contaminants from the prior manufacturing activities at the Site contaminated the shallow groundwater and the resulting plumes of contaminated groundwater became commingled. The contaminant plume extends northwards, and underlies other properties. The remedy for the contamination, finalized in 1990, included soil-vapor extraction and treatment, groundwater extraction and treatment, and groundwater monitoring. This is the third “Five-Year” review for the Site, and it covers remedial activities conducted between January 1, 2000 and December 31, 2004. The previous five-year review was submitted by the California Regional Water Quality Control Board, San Francisco Region (“Water Board”) to the U.S. Environmental Protection Agency on September 20, 2000 and reviewed activities completed between January 1, 1995 and December 31, 1999.

Remedial actions conducted at the Site have been successful and continue to remove contaminants. Two soil-vapor extraction systems were operated, one at the former Intersil, Inc. (“Intersil”) facility and one at the former Siemens Components, Inc. (“Siemens”) facility, and have achieved soil cleanup standards. Three groundwater extraction systems (GWETs), one at the former Intersil facility, one at the former Siemens facility, and one in the Off-Site Study Area, from which groundwater is treated by the treatment system at the former Siemens facility, have continued to operate during this review period. The systems extract groundwater from the A and B zones. In addition, the system for the former Siemens facility extracts groundwater from the former vadose-zone soils that has become saturated due to rise in water table (hereinafter referred to as the resaturated zone). Contaminant concentrations in the plume have continued to decline over the review period with some contraction at the perimeters. Based on present knowledge of vapor intrusion and toxicology, the remedy is considered to be protective of human health and the environment.

The remedy at Intersil/Siemens currently protects human health and the environment because exposure pathways that could result in unacceptable risks are either being controlled, such as the hydraulic control of plume migration and water supply through municipal utilities; or have been remediated, including the soil source area; or are incomplete, such as vapor intrusion at the former Intersil site. However, in order for the remedy to be protective in the long-term, a deed restriction for the former Siemens site needs to be implemented to prohibit use of shallow groundwater and to investigate the potential for soil vapor intrusion if the property is redeveloped. The groundwater monitoring program in the off-site area should continue and the vapor intrusion potential should be evaluated if groundwater-VOC concentrations increase.



<b>Five-Year Review Summary Form</b>		
<b>SITE IDENTIFICATION</b>		
<b>Site Name</b> (from WasteLAN): <b>Intersil/Siemens</b>		
<b>EPA ID</b> (from WasteLAN): Intersil – CAD041472341 Siemens – CAD053236212		
<b>Region: 9</b>	<b>State: CA</b>	<b>City/County: Cupertino /Santa Clara</b>
<b>SITE STATUS</b>		
<b>NPL Status: Final</b>		
<b>Remediation Status: Operating</b>		
<b>Multiple OUs? No</b>	<b>Construction Completion Date: 09/08/1992</b>	
<b>Has site been put into reuse? A portion of the Site is in use and remedial operations continue.</b>		
<b>REVIEW STATUS</b>		
<b>Lead Agency: State of California</b>		
<b>Author Name: Roger W. Papler, P.G.</b>		
<b>Author Title: Engineering Geologist</b>	<b>Author Affiliation: CA Regional Water Quality Control Board (Lead Agency)</b>	
<b>Review Period: 01/01/2000 – 12/31/2004</b>		
<b>Date(s) of Site Inspection: 08/11/2005</b>		
<b>Type of Review: (in bold)</b> <input type="checkbox"/> Post-Sara <input type="checkbox"/> Pre-Sara <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action Site <input checked="" type="checkbox"/> <b>NPL State/Tribe-lead</b> <input type="checkbox"/> Regional Discretion		
<b>Review Number: (in bold)</b> <input type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input checked="" type="checkbox"/> <b>3 (third)</b> <input type="checkbox"/> Other (specify)		
<b>Triggering Action: (in bold)</b> <input type="checkbox"/> Actual RA On-site Construction at OU#___ <input type="checkbox"/> Actual RA Start at OU#___ <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> <b>Previous Five-Year Review Report</b> <input type="checkbox"/> Other (specify)		
<b>Triggering Action Date</b> (from WasteLAN): 09/28/2000		
<b>Due Date</b> (five years after triggering action date): 09/20/2005		

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### **Five-Year Summary Form (*continued*)**

**Issues:**

The ability of groundwater extraction and treatment to reach cleanup levels over time is an issue that was identified during the review.

Institutional controls for the former Siemens site do not yet include prohibition of on-site groundwater use.

The former Siemens site lacks groundwater deed restrictions and an evaluation of the vapor intrusion pathway.

Further evaluation of the vapor intrusion pathway may be necessary should the Intersil property be redeveloped.

**Recommendations and Follow-up Actions:**

The limitations of the present remedy to meet groundwater cleanup levels are recognized, but no clear alternatives are available. The concentrations of contaminants in the groundwater close to the source have been reduced significantly. The overall lateral extent of the plume both in the A zone and the B zone has been reduced over the past five years. There are three groundwater extraction systems operating but it is not clear if these systems are causing a reduction in contaminants that is significantly greater than what would be achieved by natural attenuation. At the same time, it is also uncertain if these systems will be effective enough to reduce the concentrations to acceptable levels in certain isolated pockets of high concentrations within the foreseeable future. It is, however, recommended that the existing groundwater extraction and treatment systems continue to operate pending further evaluation of these issues.

For the former Siemens site, the Water Board intends to require a new deed restriction that will incorporate on-site groundwater use prohibitions along with sensitive site uses during the impending property transfer. An ESD may be necessary to reflect new groundwater restriction institutional controls.

If the Intersil property is redeveloped, then the vapor intrusion pathway should be reevaluated.

**Protectiveness Statement:**

The remedy at Intersil/Siemens currently protects human health and the environment because exposure pathways that could result in unacceptable risks are either being controlled, such as the hydraulic control of plume migration and water supply through municipal utilities; or have been remediated including the soil source area; or are incomplete, such as vapor intrusion at the former Intersil site. However, in order for the remedy to be protective in the long-term, a deed restriction for the former Siemens site needs to be implemented to prohibit use of shallow groundwater and to investigate the potential for soil vapor intrusion if the property is redeveloped. The groundwater monitoring program in the off-site area should continue and the vapor intrusion potential should be evaluated if groundwater-VOC concentrations increase.

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**California Regional Water Quality Control Board  
San Francisco Bay Region**

**Five-Year Review**

**Intersil/Siemens Site  
Cupertino, Santa Clara County, California**

**I. INTRODUCTION**

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The State of California Regional Water Quality Control Board, conducted the five-year review of the remedy implemented at the Intersil/Siemens Superfund Site in Cupertino, California. This is the third five-year review for the Intersil/Siemens Site. The triggering action for this statutory review is the completion of the second five-year review on September 20, 2000. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

The Site consists of the following three areas as shown on Figures 1 and 2:

- Former Intersil facility, located at 10900 North Tantau Avenue, Cupertino, California (see Figure 3 for Site Plan)
- Former Siemens facility, located at 10950 North Tantau Avenue (additional address of 19000 Homestead Road), Cupertino, California (see Figure 4 for Site Plan)
- Off-Site Study Area, located north of and hydraulically downgradient from the former Intersil and Siemens facilities in Cupertino, California (Figure 2)

The plume at the former Intersil and Siemens facilities had become commingled and extends to the Off-Site Study Area. Operations and maintenance (O&M) of remedial actions for the former Intersil facility are conducted by Geomatrix Consultants, Inc. (“Geomatrix”) on behalf of General Electric Company (GE; formerly Intersil) and LFR Levine-Fricke (LFR) on behalf of SMI Holding, LLC (SMI; formerly Siemens). Groundwater remediation efforts for the Off-Site Study Area are performed jointly by Geomatrix and LFR on the joint behalf of GE and SMI. This report reviews the activities for the entire site area.

## II. SITE CHRONOLOGY

### **Former Intersil Facility**

<b>Time Period</b>	<b>Event</b>
1967 – 1988	Intersil fabricated integrated circuits, transistors, diodes, and other semiconductor devices at the facility while leasing the property from Vallco Park, Ltd.
1983	Intersil initiated investigations at its facility
1986	Intersil removed in-ground waste handling units
June 1986	Waste Discharge Requirements/Site Cleanup Requirements (SCR), Order No. 86-49 issued
September 1987	Cleanup and Abatement Order No. 87-133 issued
November 1987	Groundwater extraction and treatment system started up
1988	Intersil removed additional in-ground waste handling units
February 1988	Intersil ceased operation at the facility
May 1988	Soil vapor extraction and treatment system started up
June 1988	Intersil/Siemens Site proposed to be added to the National Priorities List
March 1989	SCR Order No. 89-038 issued
June 1990	Intersil issued the Remedial Investigation Report and Feasibility Study Report
August 1990	SCR Order No. 90-119 issued (Final SCR) and final listing on the National Priorities List

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<b>Time Period</b>	<b>Event</b>
September 1990	United States Environmental Protection Agency (U.S. EPA) issued the Record of Decision
December 1992	General Electric, parent company of Intersil, purchased the property from Vallco Park, Ltd.
August 1993	Intersil decommissioned the soil vapor extraction system with Regional Water Quality Control Board (Water Board) approval
1997	Manufacturing building was demolished
October 2002	Extraction from well E17A was curtailed and extraction was increased in well W12A with Water Board approval
March 2003	Extraction wells W4A and W5A curtailed with Water Board approval

### **Former Siemens Facility**

<b>Time Period</b>	<b>Event</b>
1970 – 1995	Semiconductor manufacturing operations using solvents performed at the former Siemens facility by Litronix, Inc. (“Litronix”) and its successor, Siemens Microelectronics, Inc., formerly Siemens Components, Inc.
1982	Underground storage tanks (USTs) removed and soil and groundwater contamination discovered.
1983 – 2005	Soil-vapor extraction system (SVES) operated and expanded to 18 SVES wells by 1991, and curtailed to 4 wells by 1996.
1986 - Present	Groundwater extraction and treatment system (GWETS) operated and expansion to 13 GWET wells by 1991, and curtailed to 4 by 1996
1991	In March 1991, approximately 182 cubic yards of soil containing VOCs and semivolatile organic compounds (SVOCs) were excavated from Areas 1 and 3, which removed approximately 1,500 pounds of VOCs and SVOCs.
1993-1998	Groundwater levels at the former Siemens facility rose approximately 50 feet, reducing the vadose-zone to the interval from surface level to 45 ft bgs.
2000	An indoor air quality evaluation of VOCs was performed by Clayton Group Services, Inc. (“Clayton”) in August 2000. The collective results of Clayton’s evaluation of VOCs did not find any indication that subsurface VOC contamination beneath the buildings was resulting in elevated indoor airborne VOC concentrations.
September 2000	U.S. EPA issued the Record of Decision

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<b>Time Period</b>	<b>Event</b>
2002	<p>On July 2 and 10, 2002, groundwater extraction was voluntarily started from resaturated-zone wells LF-12A and H-1A, respectively.</p> <p>An indoor air quality investigation and risk assessment was performed by ATC Associates, Inc., in August 2002. No evidence of vapor intrusion, water stains or microbial fungal growth, was observed.</p>
2004	In June and December 2004, LFR conducted soil investigations to evaluate the success of the SVES system. None of the soil samples collected exceeded the cleanup goal of 1 milligram per kilogram (mg/kg) for total VOCs.
2005	LFR submitted a "Proposal to Curtail Soil-Vapor Extraction" for the Site dated April 19, 2005. SMI received approval to curtail SVE at the Site from the Water Board in a letter dated June 27, 2005.

### **Off-Site Study Area**

<b>Time Period</b>	<b>Event</b>
1986	Intersil/Siemens began groundwater investigations
June 1986	Waste Discharge Requirements/Site Cleanup Requirements, Order No. 86-49 issued
September 1987	Cleanup and Abatement Order No. 87-133 issued
June 1988	Intersil/Siemens Site proposed to be added to the National Priorities List
March 1989	SCR Order No. 89-038 issued
1990	Intersil/Siemens began groundwater extraction and treatment
June 1990	Intersil/Siemens issued the Remedial Investigation Report and Feasibility Study Report for the Off-Site Study Area
August 1990	SCR Order No. 90-119 issued and final listing on the National Priorities List
September 1990	U.S. EPA issued the Record of Decision
June 1991	Intersil/Siemens expanded the groundwater extraction system from two wells to three wells
December 2004	Extraction well LQ-1B curtailed and pumping increased in extraction well LR-1B with Water Board approval



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### **III. BACKGROUND**

#### **Physical Characteristics**

The Site is located in Cupertino, California and includes the former Intersil facility (10900 North Tantau Avenue), the former Siemens facility (10950 North Tantau Avenue), and the Off-Site Study Area (north of and hydraulically downgradient from the former Intersil and Siemens facilities).

Calabazas Creek is approximately 1,100 feet east of the Site and flows north-northeast approximately 7 miles into San Francisco Bay.

#### **Land Use**

The former Siemens facility is located directly adjacent to and north of the former Intersil facility. The former Siemens property still contains the former Siemens office building while the Intersil property is vacant except for the groundwater treatment system. A residential neighborhood is located immediately north of the former Siemens facility. Located to the immediate west and south are other facilities occupied by electronics firms. AMI, an electronic components manufacturer formerly located directly to the east, began remediation of its plume in 1993.

#### **Hydrogeology**

The geologic setting at the Site consists of interbedded coarse-grained sand and gravel and fine-grained silt and clay sediments, representing alluvial stream channel and associated overbank deposits. The shallow saturated sediments at the Site are divided into three water-yielding zones: the A zone, the B zone, and the C zone. Regional groundwater elevations rose approximately 50 to 55 feet, and groundwater elevation data from the former Siemens facility on-site wells indicate that this rise in water level occurred between approximately 1993 and 1998. In the off-site area, however, the water levels may have begun to rise in 1990s as indicated by the water level data from the off-site wells.

Former vadose-zone sediment that has become saturated is herein referred to as the resaturated zone and extends from 45 to 90 feet bgs. At the former Siemens site, the resaturated zone has been divided into two intervals: the upper resaturated-interval, which occurs between approximately 45 and 60 feet bgs, and the lower resaturated-interval, which occurs between approximately 60 and 90 feet bgs. The A-zone saturated sediments occur at a depth interval between approximately 90 and 125 feet bgs. At the former Intersil site, the A zone is apparently hydraulically connected with the resaturated zone. The B zone occurs between approximately 130 and 150 feet bgs. The C zone occurs between approximately 180 and 210 feet bgs. The A-, B-, and C-zone sediments are generally separated by fine-grained sediments that act as aquitards. A deep-zone regional confined aquifer (the regional aquifer) exists at depths of approximately 300 to 500 feet bgs and is separated from the C zone by an approximately 80- to 150-foot-thick aquitard interval of fine-grained sediments.

The groundwater flow direction in the A, B, and C zones, and the regional aquifer is generally northward beneath the former Intersil and Siemens facilities to the Off-Site Study Area and toward San Francisco Bay.

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## **History of Contamination**

### **Former Intersil Facility**

Intersil operated its facility as a silicon wafer fabrication plant and office building from 1967 to 1988 (Beak, 1990). In connection with these activities, Intersil used inorganic etching solutions (such as acids) and large amounts of water (up to 100,000 gallons per day) (Beak, 1990). Small amounts of TCE were used on a limited basis as a cleaning agent prior to 1979 and very small quantities of TCA were used until closure of the facility in 1988 (Beak, 1990). Intersil's processes used more acid and water than VOCs; therefore, fabrication operations required the use of only one 250-gallon in-ground vaulted waste solvent tank (Beak, 1990). This tank was located within the vault of the east neutralization system and was visible for inspection on the bottom and all sides (Beak, 1990). Wastes in the tank were pumped out monthly by a recycling company (Beak, 1990). Acid and water-based process wastewater was directed through five in-ground wastewater neutralization systems and sumps before being discharged pursuant to a permit into the sanitary sewer (Beak, 1990).

Intersil initiated investigations of the property in 1983. The investigations conducted between 1983 and 1988 involved drilling soil borings and installing groundwater monitoring wells (Beak, 1990). Results of these investigations revealed concentrations of TCE in soil beneath the northern portion of the property and in the central portion near the former inactive east neutralization system and in groundwater beneath the northern portion of the property (Beak, 1990). Interim remedial measures are discussed in the next section.

### **Former Siemens Facility**

From approximately 1970 to 1995, the former Siemens facility was used for semiconductor manufacturing operations by Litronix and its successor, SMI. Until the mid-1980s, the semiconductor manufacturing operations involved the use of various organic solvents, primarily TCE and 1,1,1-TCA. Until 1982, liquid wastes were stored in five USTs. All five tanks were removed in 1982. From 1982 until closure of facility operations in 1986, liquid wastes previously stored in USTs were temporarily placed in the HMSA for off-site disposal or recycling.

Investigations began in 1982 after the discovery of contaminants during the removal of the USTs. Investigations performed between 1982 and 1989 indicated that releases of VOCs (mainly chlorinated solvents TCE and derivatives such as 1,2-dichloroethene [1,2-DCE]) and SVOCs had occurred and had impacted soil and groundwater at levels that required remediation. The impact of groundwater contaminants was limited to the upper two aquifers (A and B zones). Groundwater samples collected from the deeper aquifer (C zone) indicated that it had not been affected.

Due to the rise in groundwater from approximately 1993 through 1998, former unsaturated soils became saturated (between 45 to 105 feet bgs) and former vadose-zone monitoring wells became resaturated-zone monitoring wells. This reduced the unsaturated vadose-zone soils to an interval of 0 to 45 feet bgs. Groundwater sampling performed in 2000 from the resaturated-zone wells indicated that both the upper and lower resaturated-intervals were also contaminated with VOCs.

### **Off-Site Study Area**

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Intersil and SMI initiated investigation of the Off-Site Study Area in 1986 (Geomatrix and Levine-Fricke, 1995). No manufacturing activities are known to have existed in the Off-Site Study Area, which is almost entirely developed for residential use, although some agricultural land use was practiced at the time of the Remedial Investigation in the late 1980s (Levine-Fricke, 1990). A-zone groundwater was not found to be impacted; therefore, no remediation of the A zone was required by the Order (Geomatrix and Levine-Fricke, 1995). In addition, no direct groundwater extraction from the C zone was required because the concentrations of VOCs in C-zone groundwater were very low compared to B-zone concentrations, and because a long-term pump test of the B-zone extraction wells generated a significant response in water levels in the C zone, indicating significant hydraulic connection between these zones (Geomatrix and Levine-Fricke, 1995). Thus, by increased pumping in the B zone, the groundwater quality of the C zone would improve (Geomatrix and Levine-Fricke, 1995). As discussed in Section V, the TCE concentrations in C-zone groundwater have been reduced to non-detect or below the Maximum Contaminant Level (MCL).

## **Initial Response**

### **Former Intersil Facility**

Interim remedial measures at the former Intersil facility included removal of the inactive east neutralization system and vaulted 250-gallon waste solvent tank (1986); design and installation of the groundwater extraction and treatment system (1987); design and installation of the soil vapor extraction and treatment system (1988); removal of the remaining wastewater treatment facilities (the north and east neutralization systems and the north and east scrubber sumps) and the former above-ground chemical and hazardous waste storage area (1988)(Geomatrix and Levine-Fricke, 1995).

The original soil vapor extraction system consisted of two extraction well pairs along the northern boundary of the property (Geomatrix and Levine-Fricke, 1995). In mid-1991, the extraction system was expanded as part of the final remedial action to four well pairs (V1S, V1D, V2S, V2D, V3S, V3D, V4S, and V4D).

The original groundwater extraction system consisted of one perched-zone groundwater extraction well (W4A) and four A-zone groundwater extraction wells (W5A, W10A, W12A, and E17A) (Geomatrix and Levine-Fricke, 1995). In May 1991, the groundwater extraction system was expanded as part of the final remedy with the addition of A-zone extraction well W9A and B-zone extraction well W18B (Geomatrix and Levine-Fricke, 1995). In December 1993, extraction well E9AR was installed to replace W9A, which was accumulating silt and causing accelerated breakdown of pumps. Groundwater is treated using an air stripper and treated effluent is discharged to Calabazas Creek under a general NPDES permit.

### **Former Siemens Facility**

Interim remedial actions for soil remediation began at the former Siemens facility in 1983 with the start-up of an on-site SVES that included one SVE well. Two additional SVE wells were installed in 1985 and another one in 1986. In 1991, as part of the final remedy, the SVES was expanded to 16 SVE wells, and then was reduced to four SVE wells in 1995. In addition, soil excavation was performed in 1991 in Areas 1 and 3, where former USTs were located.

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Interim remedial actions for groundwater remediation began in 1986 with the start-up of a GWETS, which extracted on-site groundwater from both the A and B zones. As part of the final remedy, the GWETS was expanded in 1991 to include 13 on-site extraction wells. The GWETS provides hydraulic control and remediation of the affected groundwater. Although not required by the Final SCR, SMI has also periodically operated up to five extraction wells that are screened in the lower resaturated-interval.

From 1986 through 2002, extracted groundwater was treated via two air strippers connected in series. In 2002, primary treatment of extracted groundwater was changed to granular activated carbon. Treated groundwater is discharged to Calabazas Creek under a general NPDES permit.

### **Off-Site Study Area**

Remedial action in the Off-Site Study Area commenced with an interim groundwater extraction program starting in July 1990. The interim remedial program consisted of groundwater extraction from B-zone wells LQ-2B and LR-1B (Geomatrix and Levine-Fricke, 1995). In May 1991, the extraction system was expanded as part of the final remedial action with the addition of extraction well LQ-1B (Geomatrix and Levine-Fricke, 1995). Groundwater was piped to the treatment plant at the former Siemens facility for treatment by air stripping.

## **Summary of Basis for Taking Action**

The Site overlies the Santa Clara Valley groundwater basin. Groundwater from this basin provides up to 50 percent of the municipal drinking water for over 1.4 million residents of the Santa Clara Valley. The Site was listed on the National Priorities List (NPL) primarily because of the past chemical releases' potential threat to the groundwater resource.

## **IV. REMEDIAL ACTIONS**

### **Remedy Selection**

A Baseline Public Health Evaluation for the Site was prepared along with a Remedial Investigation/Feasibility Study. These documents form the basis of the remedial action plan. The Water Board adopted Final SCR on August 15, 1990. The selected final cleanup remedy, as stated for the Site in the Final SCR, consists of the following elements:

- 1) Soil-vapor extraction and treatment and soil excavation for soil cleanup.
- 2) Groundwater extraction and treatment for groundwater cleanup.
- 3) Shallow zone and deeper aquifer groundwater monitoring and soil monitoring.

The SCRs did not include institutional control requirements.

The soil cleanup goal for the former Intersil facility is 1 mg/kg total VOCs. The soil cleanup goals for the former Siemens facility are 1 mg/kg total VOCs and 10 mg/kg total SVOCs.

The groundwater cleanup goals for the Site established by the Water Board are federal and California MCLs (proposed or adopted) and California Department of Health Services Recommended Drinking Water Action Levels. These goals are specified in Findings 15 and 18 and Specification B.4. of the Final SCR and are summarized in the following table:

Constituent	SCR Order No. 90-119		Current California MCLs (mg/l)	Current Federal MCLs (mg/l)
	Soil Cleanup Goal (mg/kg)	Groundwater Cleanup Standard (mg/l)		
Total VOCs	1	na	na	na
Total SVOCs	10	na	na	na
1,1-Dichloroethene (1,1-DCE)	na	0.006	0.006	0.007
Trichloroethene (TCE)	na	0.005	0.005	0.005
Tetrachloroethene (PCE)	na	0.005	0.005	0.005
Cis-1,2-Dichloroethene (cis-1,2-DCE)	na	0.006	0.006	0.07
Trans-1,2-Dichloroethene (trans-1,2-DCE)	na	0.01	0.01	0.1
1,1,1-Trichloroethane (1,1,1-TCA)	na	0.2	0.2	0.2
Freon 13	na	1.2	1.2	na
Toluene	na	0.15	0.15	1

Notes:

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

na = not applicable

ne = not established

In addition, the Final SCR states that “studies suggest that groundwater extraction and treatment will not be, in all cases, completely successful in reducing contaminants to health-based levels in the aquifer zones. The Water Board recognizes that operation of the selected extraction and treatment system may indicate the technical impracticability of reaching health-based groundwater quality standards using this approach. If it becomes apparent, during implementation or operation of the

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system, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal, that goal and remedy may be reevaluated.”

## **Remedy Implementation**

### **Former Intersil Facility**

The soil vapor extraction and treatment operated from May 1988 through August 1993 (Geomatrix and Levine-Fricke, 1995). Statistical analysis of the data collected in 1992 indicated that the soil cleanup objective of 1 mg/kg had been achieved (Geomatrix and Levine-Fricke, 1995). The Water Board approved curtailment of the system in a letter dated May 14, 1993. During operation, approximately 3000 pounds of VOCs were removed by the soil vapor extraction and treatment system (Geomatrix and Levine-Fricke, 1995).

The seven groundwater extraction wells operate continuously except for periodic shut downs for maintenance. Groundwater is treated using an air stripper and treated water is discharged to Calabazas Creek under the general NPDES permit. Quarterly potentiometric surface maps show that groundwater has been and continues to be contained at the former Intersil facility (e.g., Geomatrix and LFR, 2005a).

### **Former Siemens Facility**

In 1983, a SVES was installed at the former Siemens facility and expanded and later curtailed as described in Section II. The SVES effectively removed VOC mass from the vadose-zone soil and approached asymptotic conditions. Overall, the SVES removed approximately 7,850 kilograms (17,310 pounds) of VOC mass through 2004. During 2004, on behalf of SMI, LFR performed two soil sampling events to evaluate the SVES effectiveness. Based on data gathered from these investigations, SMI submitted a report to the Water Board proposing curtailment of the SVES at the former Siemens facility. The Water Board approved curtailment of the SVES in a letter dated June 27, 2005.

In 1991, SMI excavated approximately 182 cubic yards of soil containing VOCs and SVOCs, thereby removing approximately 1,500 pounds of VOCs and SVOCs.

A GWETS was installed at the former Siemens facility in July 1986. Since this time, groundwater extraction has been continuously performed from on-site extraction wells installed in the A and B zones. Presently, on-site groundwater is extracted from six on-site groundwater extraction wells in the A and B zones. Although not required by the Final SCR, SMI operates extraction wells that are screened in resaturated-zone sediments. Up to 2002, primary treatment of extracted groundwater was performed using two air strippers connected in series. From 2002 to present, granular activated carbon has been the primary treatment method. Effluent from the treatment system is discharged to Calabazas Creek under an NPDES general permit.

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## **Off-Site Study Area**

Groundwater extraction began in the B zone in 1990 with two extraction wells and was expanded to three extraction wells in 1991. Prior to extraction, a downward gradient between the B and C zones existed in the vicinity of the extraction wells (Geomatrix and Levine-Fricke, 1995). Groundwater extraction from the B zone induced a reversal in the vertical gradient from downward to upward from the C zone to the B zone (Geomatrix and Levine-Fricke, 1995). Concentrations of VOCs in the C zone have been reduced to below the MCL. Quarterly potentiometric surface maps show that groundwater in the Off-Site Study Area has been contained (e.g., Geomatrix and LFR, 2005a).

## **System Operation/O&M**

### **Former Intersil Facility**

The GWET has run continuously except for occasional shutdowns to perform equipment modifications and maintenance (e.g., quarterly NPDES reports). In August 2002, the air stripper was shutdown for 3 days to acid wash the stripper tower and the air compressor was shut down for 10 days; consequently, extraction wells E9AR, W4A, and W5A did not extract groundwater during this 10-day period (Geomatrix and LFR, 2005b).

When the system was first expanded in 1991, groundwater extraction rates were initially approximately 9 gpm. Extraction rates increased in 1993 when regional groundwater levels rose about 20 feet (Geomatrix and Levine-Fricke, 1995). Extraction rates remained fairly constant at approximately 48 to 50 gpm from 1993 until 2002. In 2002 and 2003, extraction wells E17A, W4A, and W5A were curtailed and the pumping rate was increased at well W12A, as discussed in Section V (Geomatrix and LFR, 2005a). The current pumping rate is approximately 45 gpm. The groundwater remedial system is currently extracting and treating approximately 23 million gallons per year. Actual O&M, monitoring, NPDES, labor, and other expenses between January 2000 and December 2004 for the GWET was \$1,223,000. Additional costs included the Santa Clara Valley Water District fee to discharge treated water to the creek (\$129,000), and the power to run the systems (\$77,000). Thus, the total annual cost for O&M and monitoring was \$1,429,000 (*Five-Year Status Report for the Period 2000 through 2004, June 28, 2005*).

### **Former Siemens Facility**

The SVES and GWETS have been operational since 1983 and 1986, respectively. Quarterly Self-Monitoring Reports for the GWETS to the Water Board are routinely submitted. These reports indicate that the system is operating as designed during the reporting period.

Actual O&M costs between January 2000 and December 2004 for the SVES were \$43,000 and for the GWETS were \$334,000. Additional costs included the Santa Clara Valley Water District fee to discharge treated water to the creek (\$194,000), the power to run the systems (\$52,000), soil-vapor monitoring (\$31,000), and groundwater monitoring (\$201,000). Thus, the total annual cost for O&M and monitoring was \$855,000, which is less than the amount projected in 1999 (\$1,093,000). The overall project costs were 22 percent less than the 1999 estimate outlined in the Five-Year Status Report for the Period 2000 through 2004.

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## **Off-Site Study Area**

Groundwater extracted from the three wells in the Off-Site Study Area is treated in the Siemens' treatment system. System operation was discussed in the previous section and the efficiency in mass removal is discussed in Section V.

## **V. PROGRESS SINCE LAST REVIEW**

### **Previous Five-Year Review**

As of the year 2000, VOC concentrations along the downgradient perimeter of the site had stabilized and hydraulic control of the plume had been achieved. During the five year period preceding that report, soil vapor extraction (SVE) had removed almost 800 pounds of VOC and reduced levels in the vadose zone to relatively low concentrations. Although the SVE operation had not achieved the target levels at Former Siemens at the time, remedial actions were functioning as designed and considered to protect public health and the environment.

### **Former Intersil Facility**

#### ***Groundwater Remediation***

TCE concentrations in A- and B-zone groundwater extraction wells at the former Intersil facility have decreased within the affected area since the last five-year review. Extraction well W10A has the highest TCE concentrations of the four extraction wells, and groundwater from extraction well W18B provides the majority of the flow into the treatment plant. TCE concentrations have decreased in well W10A from 170 ug/l in October 1999 to 79 ug/l in October 2004 and in well W18B from 18 ug/l in October 1999 to 12 ug/l in October 2004.

The concentrations of TCE in groundwater from wells that historically contained the highest concentrations have been significantly reduced since groundwater extraction was started in 1987. Although the lateral extent of TCE in the A zone at the former Intersil facility is similar in 1999 and 2004, the concentrations within the plume have decreased. TCE concentrations in the B zone show a decrease in lateral extent and concentrations between 1999 and 2004.

Over the past five years, total VOC concentrations in the influent (extracted) groundwater to the treatment system have generally decreased from a maximum of 153 ug/l in 2000 to a minimum of 65 ug/l in 2004, with an average of approximately 98 ug/l. The average mass removal rate has decreased to 0.04 pound per day in 2004 from 0.14 pound per day in 1995 and 0.11 pound per day in 1999. From January 2000 to December 2004, approximately 101.7 pounds of total VOCs were removed from groundwater beneath the former Intersil facility, and approximately 463.4 pounds of total VOCs have been removed since system start up in 1987.

Approximately 306.4 million gallons of groundwater were extracted to remove VOCs from November 1987 through December 2004; however, the majority of that groundwater has been extracted since 1994. The system is currently treating approximately 23.3 million gallons per year. Removal efficiency of the treatment system decreased by approximately 61 percent from 1.59 pounds



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of total VOCs removed per million gallons extracted in December 1999 to 0.61 pound per million gallons extracted in December 2004. The rate of VOC removal has been less than 1 pound per million gallons for the past four years. Removal efficiency has decreased significantly over time and progress toward meeting the remediation objective is occurring very slowly.

### ***Additional Work Performed During Reporting Period***

In October 2004, Geomatrix collected groundwater samples from the former vent wells located in the northern portion of the former Intersil facility. These wells were originally installed as part of the soil vapor extraction system. As a result of a regional rise in water table elevations from the early 1990s to approximately 1998, the screened intervals of the former vent wells are now partially to completely submerged. The sampling methodology was described and the data were presented in the Annual Self-Monitoring Report, January 1 through December 31, 2004 (Geomatrix and LFR, 2005a). TCE concentrations in the shallow former vent wells (sampled at depths of approximately 58 to 62 feet bgs) ranged from 39 ug/l to 260 ug/l. TCE concentrations in the deeper former vent wells (sampled at depths of approximately 75 to 80 feet bgs) ranged from 54 ug/l to 300 ug/l. Using a numerical groundwater flow model by S.S. Papadopoulos & Associates (SSP&A) and Geomatrix (e.g., 2003), it was concluded that pumping from lower A-zone and B-zone extraction wells contains the resaturated-zone groundwater.

### ***Soil Vapor Evaluation***

Vapor intrusion into indoor air is not an issue because the only structure on the property is the groundwater treatment plant, which is an open structure without a roof, and the highest concentration of TCE in groundwater 300 ug/l) is less than the Water Board's Environmental Screening Level (ESL) for the protection of indoor air of 520 ug/l for residential. A deed restriction is being prepared that will require an evaluation of vapor intrusion into indoor air if a plan is proposed to develop the property in the future.

### **Former Siemens Facility**

#### ***Groundwater Remediation***

Although concentrations of several compounds remain above the remedial goals listed in Section IV, the VOCs in groundwater samples from the A- and B-zone wells have decreased to asymptotic concentrations. TCE concentrations in well LF-6A have decreased from a historical maximum of 470 ug/l in May 1990 to approximately 50 ug/l in December 1995 and to 180 ug/l in December 2004. Similarly, TCE concentrations in well H-5B decreased from a historical maximum of 2,100 ug/l in November 1991 to below 500 ug/l in December 1995, and have remained at or below this concentration through December 2004. Likewise, TCE concentrations in well H-5B decreased further during this five-year reporting period from 510 ug/l in October 2000 to 150 ug/l in October 2004.

Remedial goals for A-zone groundwater have been achieved for all VOCs, with the exception of TCE, cis-1,2-DCE (only in two A-zone wells), and 1,1-DCE (only in two A-zone wells). Similarly, remedial goals for VOCs in B-zone groundwater have been achieved for all VOCs, with the exception of TCE and cis-1,2-DCE (only in one B-zone well). No chemicals exceed their respective remedial goals in C-zone groundwater at the former Siemens facility.

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Influent VOC concentrations have significantly decreased since start-up of the expanded system in 1991, and have been approaching asymptotic concentrations since approximately 1994. The VOC mass removal rate has remained below 0.5 pound per day since 1996 and is also approaching asymptotic conditions. The cumulative average mass removed from groundwater using GWETS since start-up in 1986 is 2,865 pounds. During the recent five-year period, approximately 523 pounds of VOCs were removed.

From January 2000 to December 2004, approximately 181.5 million gallons of water were extracted and approximately 345 pounds of total VOCs were removed from the former Siemens facility on-site wells. The volume of groundwater extracted has increased in the last few years due to the addition of two new extraction wells in the resaturated zone. The extraction efficiency has decreased from 3.7 pounds of VOCs per million gallons extracted (lbs/MG) in 2000 to 1.3 lbs/MG in 2004.

### ***Soil Remediation***

The VOC concentrations in SVE wells have decreased significantly since start-up of the expanded SVES in 1991, and have reached asymptotic concentrations. The SVES influent VOC concentrations since system expansion have declined from approximately 30 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ) in December 1995 to approximately 12  $\text{mg}/\text{m}^3$  in March 2000 and approximately 4  $\text{mg}/\text{m}^3$  in August 2004.

The VOC mass removal rate has declined from approximately 0.23 pound per day in 1999 to less than approximately 0.10 pound per day in 2004. During this five-year reporting period from, the SVES removed approximately 184 pounds of VOCs, which is much less than the previous five-year removal of approximately 790 pounds. The VOC removal rate for soil vapor has continued to decrease from an average removal rate of 0.7 lb of VOCs/day during the previous five-year reporting period to an average rate of 0.13 lb of VOCs/day during this five-year reporting period.

During 2004, on behalf of SMI, LFR performed two soil sampling events. The first event was to further characterize the southern area of the Site, and the second event was to collect further data to supplement the first investigation and confirm whether vadose-zone soils have been cleaned to below the Final SCR cleanup goal of 1  $\text{mg}/\text{kg}$  for total VOCs. Based on data gathered from these investigations, SMI submitted a report to the Water Board proposing curtailment of the SVES at the former Siemens facility. Based on the achievement of the soil-cleanup levels of the SCRs, the Water Board approved the curtailment.

### ***Soil Vapor Evaluation***

Because there is a building located at the former Siemens facility used for commercial purposes, two indoor air sampling events were conducted in August 2000 and 2002. The results of these samples indicated non-detectable levels of the VOCs of concern. Because the SVE system did not operate during daytime office hours, it should be noted that the samples were collected when the SVE system was turned off but not after the SVE system had been shut down for a substantial period. At that time, the consultant concluded that there were no risks to public health based on that data. However, the reporting limits for TCE and vinyl chloride were higher than the recently revised February 2005 Environmental Screening Levels (ESLs) for indoor vapor intrusion. Additional indoor air sampling is planned when the existing SVE system has been shut down long enough to allow equilibrium to be

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re-established in the vadose zone. Siemens does not plan to dismantle the SVE system until potential indoor vapor intrusion issues have been addressed.

Although potential indoor vapor intrusion issues require additional verification, three of the four groundwater samples collected in 2004 around the Siemens building and tested for TCE are below the Water Board's Environmental Screening Level (ESL) for the protection of indoor air of 520 ug/l in residential areas underlain by high permeability soils. The fourth sample had a concentration of TCE in groundwater (620 ug/l) which is less than the Water Board's Environmental Screening Level (ESL) for the protection of indoor air of 2,000 ug/l in industrial settings on high permeability soils. In addition, the site is underlain by five to ten feet of low permeability silty clay soils and the respective residential and commercial/industrial ESLs for TCE vapor intrusion from groundwater at sites underlain by these types of soils are 2,000 ug/l and 6,900 ug/l, respectively.

In September 2002, EPA's Office of Solid Waste and Emergency Response (OSWER) released an external review draft "*Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*" (2002) that focuses specifically on this pathway. EPA considers many factors in determining whether there is a potential for vapor intrusion from groundwater contamination, including depth to groundwater, soil type and concentration of contaminant. Given the concentrations of TCE in groundwater (45ug/L), the soil type, and the depth to groundwater (approximately 45 feet); the current understanding of the vapor intrusion pathway; and using a 1 ug/m<sup>3</sup> target indoor air TCE concentration, the results from the Johnson and Ettinger model indicates that remedy is currently protective for the indoor air pathway in the off-site area. However, the vapor intrusion pathway is an emerging issue, for which, the science continues to evolve. The evaluation of potential off-site exposures due to vapor intrusion will need to be updated in subsequent Five-Year Reviews.

It is the understanding of this Regional Board that the Siemens property will be sold in the near future. At that time, the Water Board will require an updated deed restriction that incorporates an evaluation of vapor intrusion and prohibits sensitive uses.

### **Off-Site Study Area**

#### ***Groundwater Remediation***

In the A zone, no groundwater extraction was required by the Order in the Off-Site Study Area. Concentrations of TCE in monitoring well S-1A have increased since the previous five-year report. TCE was not detected in well S-1A until October 1999, when it was detected at 2.7 ug/l. It was concluded that remnant VOCs in the former vadose zone had been mobilized by the 50-foot rise in groundwater levels. In response, several A-zone extraction wells were installed along the downgradient (north) end of the former Siemens site to contain the A-zone groundwater plume. TCE levels have fluctuated since then and were most recently measured at 45 ug/l in October 2004. Groundwater modeling indicates that groundwater at this location is contained by extraction from B-zone extraction wells in the Off-Site Study Area (Geomatrix and LFR, 2005b).

In the B zone, the extraction system has consistently maintained containment of affected groundwater and there has been no significant change in containment since implementation of the final remedy (Geomatrix and LFR, 2005b). Concentrations of VOCs in the off-site B zone have generally been reduced over this five-year reporting period. The extent of TCE in the B zone above 5ug/l does not extend as far north as it did in 1999 because the concentration in well IQ-1B has decreased from 10 ug/l to below 1ug/l; however, the TCE concentration in well IQ-1B fluctuates seasonally. TCE

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concentrations also have generally decreased in other off-site B-zone monitoring wells. Concentrations of VOCs, primarily TCE, have been reduced by nearly an order of magnitude in the off-site B-zone groundwater extraction wells since start-up in 1990 (Geomatrix and LFR, 2005b).

Historically, chemicals detected in groundwater samples from C-zone monitoring wells have included TCE, 1,1,1 trichloroethane, 1,1 DCE, toluene, and Freon 113. As reported in the 1995 five-year report, TCE was the only compound detected in off-site C-zone groundwater at concentrations exceeding cleanup goals established in the Order; however, TCE concentrations were reduced by 1999 to below the cleanup goal established in the Order (Geomatrix and LFR, 2005b).

From January 2000 to December 2004, approximately 158.7 million gallons of water were extracted and approximately 144 pounds of total VOCs were removed from the Off-Site Study Area (Geomatrix and LFR, 2005b). The efficiency of the extraction and treatment system, based on the off-site extraction wells only, started at almost 4 pounds per million gallons in 1990 and decreased to approximately 1.4 pounds per million gallons in 1995 through 1999 and then decreased further to 0.76 pound per million gallons in 2004 (Geomatrix and LFR, 2005b).

### ***Additional Work Performed During Reporting Period***

During the system upgrades for the former Siemens facility, the shutdown and start-up of the system provided an opportunity to record groundwater level response during pumping and non-pumping conditions. Response was recorded at several monitoring wells at the former Siemens and Intersil facilities and at the Off-Site Study Area (Geomatrix and LFR, 2005a, b).

Seven monitoring wells (S-1A, QH-1A, KR-1B, S-2B, IQ-1B, LR-3C, and KR-2CP) located in the Off-Site Study Area and two monitoring wells (W3A and W14B) located in the southern portion of the Intersil facility were instrumented with transducers and data loggers before the extraction system was shut down on February 9, 2004. Groundwater monitoring with transducers and data loggers began three days prior to shutdown and continued for three days after the extraction system was restarted. Groundwater levels were also measured manually at 13 additional monitoring wells (three A-zone wells, six B-zone wells, and four C-zone wells) (Geomatrix and LFR, 2005a, b).

System shutdown occurred at approximately 7:30 A.M. on February 9, 2004. System start-up occurred at approximately 4:10 P.M. on March 1, 2004. Recorded hydraulic response to shutdown and restart of the extraction system ranged from no apparent change to approximately 3 feet (LFR and Geomatrix 2005a, b).

### ***Soil Vapor Evaluation***

The determination of whether vapor intrusion into indoor air is a concern in residential areas involves several factors: the depth to the shallowest water, the soil type and the contaminant concentrations. The current depth to water is 45 feet. The well logs show that the first five to ten feet of soil is dense and less permeable. The highest concentrations of TCE in the off-site area are in the B-zone which would not impact the soil vapor. The A-zone water was initially not impacted by TCE, but as the water table rose, the A-zone became impacted. In 2004, the highest concentration in the A-zone is 45 ug/l which is significantly less than the Water Board's ESL for the protection of indoor air of 520 ug/l in residential areas. EPA does not set a screening level number, but generally scrutinizes sites more if

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the TCE concentrations are much greater than the MCL of 5 ug/l. Although the TCE at the off-site area are greater than the MCL, the depth to groundwater and the type of soil indicates that vapor intrusion is not likely in this area. If TCE levels increase in the off-site resaturated-zone well, potential indoor vapor intrusion hazards will be re-evaluated.

## **VI. FIVE-YEAR REVIEW PROCESS**

### **Administrative Components**

The Intersil/Siemens Five-Year Review team was led by Roger Papler of RWQCB, Remedial Project Manager (RPM) for the Intersil/Siemens Site. Penelope McDaniel and Dana Barton of EPA assisted in the review as the representative for the support agency.

### **Community Involvement**

On August 24, 2005 a public notice was placed in the San Jose City Times, a county-wide newspaper that is circulated within the town of Cupertino. This public notice informed the public that a five-year review was being conducted and comments can be directed to the RWQCB. On September 28, 2005, the public notice will also be published in the Cupertino Courier newspaper. After this Five-Year Review report is signed, a fact sheet will be distributed that announces that the Five-Year Review report for the Intersil/Siemens Superfund site is complete, and that the results of the review and the report are available to the public.

No interviews were planned or conducted.

### **Document Review**

This five-year review consists of a review of relevant documents including the "Five-Year Status Report for the period 2000 through 2004, Intersil/Siemens Site, Cupertino, California" dated June 28, 2005, and annual groundwater monitoring reports. Applicable groundwater cleanup standards contained in the Final SCR were reviewed. There have been no changes in the cleanup standards contained in the Final SCR.

### **Data Review**

Groundwater monitoring data collected from 1987 to 2004 were reviewed to evaluate progress in remediating the groundwater pollutant plume. The combination of SVES and GWETS has been successful in removing VOC mass from the unsaturated soils, in controlling groundwater contaminant plume migration, and in reducing concentrations of VOCs in groundwater.

During the five-year review period, from January 1, 2000 through December 31, 2004, the following actions were noted:

- The former Intersil facility GWETS extracted approximately 124.3 million gallons of groundwater with the removal of 101.7 pounds of VOCs.

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- The former Siemens facility GWETS extracted approximately 181.5 million gallons of groundwater with the removal of 345 pounds of VOCs from the on-site extraction wells only.
  - In the off-site area, the former Siemens facility GWETS extracted approximately 158.7 million gallons of groundwater with the removal of 144 pounds of VOCs..
  - The former Siemens facility SVES removed approximately 184 pounds of VOCs.

With almost 20 years of groundwater extraction, the amount of VOC mass being removed has declined considerably and concentrations in groundwater are decreasing to asymptotic levels. As a result, it is not clear if the GWETS is causing a reduction in contaminants that is significantly greater than what would be achieved by natural attenuation.

EPA performed an evaluation of the ecological risk for this five year review in August 2005 (Memo: Evaluation of ecological risk for the Five Year Review of Applied Materials, EPA ID #CAD041472341, Ned Black, September 1, 2005). It concluded that “no complete exposure pathways to ecological receptors exist at this site and therefore there is no ecological risk.”

### **Site Inspection**

The Regional Water Quality Control Board staff conducted a site inspection on August 11, 2005. No activities that could interfere with cleanup of the Site were observed.

## **VII. TECHNICAL ASSESSMENT**

### **Question A: Is the remedy functioning as intended by the decision documents?**

The remedy selected in the Final Remedial Action Plan (GWETS, SVES, and institutional controls) was implemented as planned and achieved success by removing VOCs from vadose-zone soil and soil-vapor, maintaining plume control, reducing VOC concentrations in groundwater, and requiring deed restrictions on groundwater use. The contamination is confined to the A and B zones and has not affected the deeper C zone. The current groundwater monitoring program is sufficient to evaluate the effectiveness of the remedial actions.

Both the former Intersil and Siemens facilities have received Water Board approval for curtailing their SVES as VOC concentrations have been reduced in the unsaturated vadose-zone soils to below the cleanup goals.

The goal of the remedy, described in 1990, was to reduce the contamination in the groundwater to drinking water standards within a reasonable period of time. Remedial efforts for groundwater have been performed for almost 20 years at the former Intersil and Siemens facilities and for approximately 14 years in the Off-Site Study Area. The groundwater data collected since 1990 indicate that with the current remedy, the time required for cleanup cannot be projected and will be significantly in excess of 20 years.

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For the Intersil site, a deed restriction is currently in the process of being recorded that would prohibit on-site groundwater use and usage of the site for residential occupancy, hospitals, schools for persons under 21 years of age, and day care centers or centers for senior citizens. . The RP has agreed to evaluate the potential for vapor intrusion before redeveloping this site. No activities were observed that would have violated the institutional controls that are currently in place.

The institutional controls that are in place at the former Siemens site include prohibitions on the use of the site for residential occupation, hospitals, day care centers, and schools. These institutional controls are established through the Deed Restriction recorded on February 14, 2003 in the Santa Clara County Clerk-Recorder's office. As part of this Five-Year Review by the RWQCB, a title search was performed verifying that the title had been amended by the deed restriction. No activities were observed that would have violated the institutional controls. During the impending sale of this property, the Water Board intends to require a deed restriction that incorporates prohibition of groundwater usage and sensitive uses of the site.

**Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?**

This section discusses changes in site conditions, changes in exposure pathways, changes in toxicity values, changes in remedial action objectives, and changes in applicable or relevant and appropriate requirements (ARARs) that may impact the site remedy.

**Changes in Site Conditions**

The former Intersil facility is currently vacant with no enclosed building. The building at the former Siemens facility is presently occupied and used for commercial activities. The use of the downgradient area under which the groundwater plume has migrated remains residential. These changes do not impact the selected remedy.

**Changes in Exposure Pathways**

A baseline public health evaluation (BPHE) for the Site was completed in 1990. This BPHE was incorporated into the Remedial Investigation Report and Final Remedial Action Plan, and was used in evaluating and selecting remedial options for the Site. The health evaluation focused on the potential for future exposure to contamination if the groundwater and its contaminant sources were left untreated (i.e., "no action" remedial alternative) under current- and possible future-use conditions. The BPHE evaluated the entire Site, which includes the former Intersil facility, the former Siemens facility, and the Off-Site Study Area. Under current-use conditions, the BPHE identified three potential exposure pathways:

- 1) Ingestion of water from an existing municipal water supply well located downgradient of the Site area;
- 2) Inhalation of VOCs volatilized from this same municipal water supply; and
- 3) Inhalation of chemicals volatilized from source area soils.

In addition, the BPHE considered these future exposure pathways:

- 4) Inhalation of VOCs volatilized from untreated groundwater from the A, B, and C zones;

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- 5) Ingestion of untreated groundwater from the A, B, and C zones; and
  - 6) Direct contact with soils by children and adults.

It should be noted that the first two exposure pathways are not complete with respect to the Site as the available data does not appear to indicate that the VOCs released from the Site have affected the municipal water supply. Municipal well #24 is situated directly downgradient from the Former AMI site and cross-downgradient from Former Siemens. Also, there is not currently a complete pathway for scenarios number five because the impacted zones in the study are not currently in use for water supply. Finally, the soils have been remediated to clean-up levels and therefore do not pose a threat to direct contact exposure.

Thus the only potentially complete pathway was the inhalation of VOCs from the groundwater or source areas to indoor air.

In September 2002, EPA's Office of Solid Waste and Emergency Response (OSWER) released an external review draft "*Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*" (2002) that focuses specifically on this pathway. EPA considers many factors in determining whether there is a potential for vapor intrusion from groundwater contamination, including depth to groundwater, soil type and concentration of contaminant. Given the concentrations of TCE in groundwater (45ug/L), the soil type, and the depth to groundwater (approximately 45 feet); the current understanding of the vapor intrusion pathway; and using a 1 ug/m<sup>3</sup> target indoor air TCE concentration, the results from the Johnson and Ettinger model indicates that remedy is currently protective for the indoor air pathway in the off-site area. However, the vapor intrusion pathway is an emerging issue, for which, the science continues to evolve. The evaluation of potential off-site exposures due to vapor intrusion will need to be updated in subsequent Five-Year Reviews.

In February 2005, the Water Board released the updated Environmental Screening Levels (ESLs) for vapor intrusion concerns from groundwater. For commercial/industrial facilities on low permeability soils, the ESLs for groundwater that protect indoor air are 54,000 ug/l for cis-1,2-DCE and 6,900 ug/l for TCE. For residential areas, the ESLs for TCE are 520 ug/l for high permeability soils and 2000 ug/l for low permeability soils. Cross sections for the site indicate the presence of five to ten feet of low permeability silty clay.

Irrespective of the screening criteria used by the State or by EPA, the current vapor intrusion pathway is incomplete at the former Intersil facility because the facility is presently vacant (there is no enclosed building located on the property). The deed restriction in the process of being recorded for this property will require evaluating this site for potential vapor intrusion. For the former Siemens facility, the third pathway could be applicable, as there is one building at the facility used for commercial purposes. Two indoor air sampling events have been performed, indicating that there was no significant health risk from vapor intrusion. However, as discussed above, the laboratory reporting limits for these analyses were higher than the Water Board's updated ESLs for indoor vapor air intrusion; therefore additional indoor vapor samples will be collected after the SVE system has been shut down long enough to allow the vadose zone to re-establish equilibrium with the atmosphere. Siemens does not plan to dismantle the existing SVE system until potential vapor intrusion issues are addressed.



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### **Changes in Toxicity Values**

Since the 1990 health evaluation, there have been a number of changes to the toxicity values for certain contaminants of concern at the Site. Revisions to the toxicity values for 1,1-DCE and vinyl chloride indicate a lower risk from exposure to these chemicals than previously considered. On the other hand, evaluation of the toxicity values for PCE and TCE is ongoing and may indicate higher risks from exposure than previously considered.

The greatest uncertainty with toxicological changes for the Site is associated with TCE. In August 2001, U.S. EPA's Office of Research and Development (ORD) released the draft "Trichloroethylene Health Risk Assessment: Synthesis and Characterization" ("TCE Health Risk Assessment") for external peer review. The draft TCE Health Risk Assessment takes into account recent scientific studies of the health risks posed by TCE. According to the draft TCE Health Risk Assessment, for those who have increased susceptibility and/or higher background exposures, TCE could pose a higher risk through inhalation than previously considered. The draft TCE Health Risk Assessment is available on-line at: <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=23249>.

The Science Advisory Board, a team of outside experts convened by U.S. EPA, reviewed the draft TCE Health Risk Assessment in 2002. The Science Advisory Board's review of the draft TCE Health Risk Assessment is available at: <http://www.epa.gov/sab/pdf/ehc03002.pdf>.

U. S. EPA's ORD and Office of Solid Waste and Emergency Response have requested additional external peer review of the draft TCE Health Risk Assessment by the National Academy of Sciences. Consequently, review of the toxicity value for TCE may continue for a number of years. This issue will need to be updated in subsequent five-year reviews.

### **Changes in Remedial Action Objectives**

The Final Remedial Action Plan for the Site, approved by the Water Board and U.S. EPA in the Final SCR in 1990, focused on reducing the concentrations of contaminants in both the soil source area and in the groundwater. The groundwater cleanup goals for the Site are federal and California MCLs (proposed or adopted) and California Department of Health Services Recommended Drinking Water Action Levels. These levels are summarized in Section IV - Remedial Actions, Remedy Section. No changes have been made to these objectives.

### **Changes in ARARs**

The California MCLs have not changed since the Final SCR was adopted in 1990, except that the current MCL for toluene is 150 ug/l; the California Recommended Drinking Water Action Level for toluene was 100 ug/l in 1990. Several of the current federal MCLs are higher than the 1990 cleanup standards, including 1,1-DCE and cis-1,2-DCE.

ARARs and cleanup levels for soil contamination at the Site have been met in accordance with the Final SCR. There have been no changes in ARARs that would affect operations or the protectiveness of the remedy.

One of the action-specific ARARs from the ROD cites the NPDES discharge standards in accordance with the Water Board's Water Quality Control Plan, San Francisco Bay Region, Region 2 (1995). The Basin Plan references standards that were adopted from U.S. EPA's Ambient Water Quality Criteria, as adopted by the Water Board in 1986. In 2000, U. S. EPA promulgated the California Toxics Rule,

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which updates and adds standards for discharges to surface waters. The California Toxics Rule standards for VOCs are not lower than those in the NPDES permits for the groundwater treatment systems; therefore, these new standards do not affect the NPDES discharge standards for the treated effluent, and they do not affect the protectiveness of the remedy.

**Question C: Has any other information come to light that could call into question the protectiveness of the remedy?**

At the time of this review, there is no information available that would question the protectiveness of the remedy.

**Technical Assessment Summary**

According to the data reviewed and the inspection of the Site, the remedy is functioning as intended by the SCRs in the short term. There have been no changes in the physical condition or land use of the Site that would reduce the protectiveness of the remedy.

## **VIII. ISSUES**

The main issue identified during the review is the present lack of institutional controls at the former Intersil site. However, Intersil is in the process of recording a deed restriction that prohibits on-site groundwater use, and using the site for residential occupation, hospitals, schools for persons under 21 years of age, day care centers or centers for senior citizens. The RP has also agreed to evaluate the potential for vapor intrusion before redeveloping the site. With the impending sale of the former Siemens site, the RP will be recording a new deed restriction with the same prohibitions as the Intersil covenant. Potential off-site vapor intrusion hazards will be addressed by monitoring the chlorinated VOC levels in the off-site resaturated-zone. The indoor air intrusion potential should be re-evaluated if groundwater VOC concentrations increase.

The other issue identified during the review was the recognition that groundwater conditions are approaching asymptotic levels and the present remedy was not likely to achieve the cleanup goals in any predictable time period. Accordingly, it appears that an evaluation of other remedial options and whether reaching the current cleanup goals is technically impracticable is appropriate during the next five-year period.

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## IX. RECOMMENDATIONS AND FOLLOW UP ACTIONS

SMI and GE will continue to monitor groundwater quality for several years. It is recommended that the existing GWETSs continue to operate pending further evaluation of the feasibility of other remedial options.

Issue	Recommendation	Responsible Party	Oversight Agency	Date	Affects Protectiveness
Present lack of institutional controls at the former Intersil site.	The RP is required to incorporate prohibiting on-site groundwater use and evaluating the potential for vapor intrusion.	Intersil	RWQCB	2007	Short-term: No Long-term: Yes
Present lack of institutional controls at the former Siemens site.	The RP is required to incorporate groundwater deed restrictions prohibiting on-site groundwater use, and evaluating the vapor intrusion pathway.	Siemens			Short-term: No Long-term: Yes
Groundwater extraction and treatment is not likely to achieve cleanup goals.	Continue to operate existing groundwater extraction and treatment systems. Continue to monitor groundwater quality. Evaluate feasibility of other active remedial options.	Intersil and Siemens	RWQCB	2007	Short-term: No Long-term: No

## X. PROTECTIVENESS STATEMENT

The remedy at Intersil/Siemens currently protects human health and the environment because exposure pathways that could result in unacceptable risks are either being controlled, such as the hydraulic control of plume migration and water supply through municipal utilities; or have been remediated including the soil source area; or are incomplete for the Former Intersil site through the vapor intrusion pathway. However, in order for the remedy to be protective in the long-term, a deed restriction for the Former Siemens site needs to be implemented to prohibit use of shallow groundwater and to investigate the potential for soil vapor intrusion if the property is redeveloped. The groundwater monitoring program in the off-site area should continue and the vapor intrusion potential should be evaluated if groundwater-VOC concentrations increase.

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## **XI. NEXT REVIEW**

The next five-year review for the Site is required by September 2010. The next Five-Year Summary Report for the Site is scheduled to be submitted to the Water Board by July 30, 2010.

## **XII. REFERENCES**

- Beak, 1990. Remedial Investigation Report, Former Intersil Facility, 10900 North Tantau Avenue, Cupertino, California. June.
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